VACCINE UPTAKE IN CANADIAN ADULTS

RESULTS FROM THE 2016 ADULT NATIONAL IMMUNIZATION COVERAGE SURVEY (aNICS)

PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH

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KEY FINDINGS

- Vaccination coverage in Canadian adults remained relatively stable over the last ten years for seasonal influenza, pneumococcal and tetanus vaccination. Reported pertussis vaccination coverage has increased over survey cycles, but remains low.
- National vaccination coverage goals for adulthood vaccines were not met for influenza and pneumococcal vaccination.
- More effort is required to increase adult vaccination coverage in Canada, particularly among high-risk groups.

INTRODUCTION

Vaccines have been one of public health's greatest achievements. They are effective in preventing morbidity and mortality associated with certain infectious diseases. While the majority of routine vaccination occurs during childhood, some vaccines are also recommended in adulthood. Adult vaccines are important for the following reasons:

- Immunity against certain vaccine-preventable diseases wanes over time and requires boosting;
- Some vaccine-preventable infections, such as varicella, are more virulent in adults and can cause serious health complications and even death;
- Adult vaccination can help boost immunity against certain diseases that are more common in adulthood (e.g. herpes zoster, also known as shingles);
- Adult vaccination helps prevent individual infection, decreasing the risk of transmission to those who are vulnerable (unable to be vaccinated for medical reasons), are not yet fully vaccinated or are unable to build strong immunity following vaccination.

Since 1991, the Public Health Agency of Canada has been monitoring national vaccination coverage for selected adult vaccines (1). The adult National Immunization Coverage Survey (aNICS) was first conducted in 2001, and has been routinely administered every two years since 2006. Results from aNICS are used to monitor coverage at the national level for vaccines recommended by the National Advisory Committee on Immunization (NACI), to report vaccination coverage estimates against national coverage goals and to inform vaccination program and public education strategies. Coverage for seasonal influenza, pneumococcal, hepatitis B, tetanus, and pertussis containing vaccines is estimated for the general, non-institutionalized adult population (18 years of age and older). Coverage is also reported for specific target groups recommended by NACI, including seniors 65 years of age and older, and those aged 18 to 64 years with a chronic medical condition. Varicella vaccine coverage is estimated for adults younger than 50 years of age who reported not having had varicella infection (chickenpox) as a child, while herpes zoster (shingles) vaccine coverage is measured in adults 50 years of age and older. Finally, human papillomavirus (HPV) vaccine coverage is estimated in adults 45 years of age and under.

The aNICS was conducted in 2001, 2006, 2008, 2010, 2012, 2014, and 2016. This report details the survey results from the 2016 cycle and trends in coverage estimates over the past six cycles, from 2006 to 2016.

METHODOLOGY

Questionnaire

The questionnaire was developed in consultation with vaccination experts across Canada. The survey included demographic questions on age, gender, education, employment status, household income, and country of birth.

Respondents were asked if they had been vaccinated against the following:

- Seasonal influenza in the previous year;
- Hepatitis B in their lifetime;
- Pertussis in adulthood;
- Tetanus in the previous 10 years;
- Varicella (participants under 50 years of age);
- Shingles (participants 50 years of age and older);
- HPV (participants under 45 years of age);
- Pneumococcal (participants 65 years of age or older, and those with chronic medical conditions).

Sampling

Respondents from every province and territory were selected using random digit dialing (RDD). Both households with landlines and those cellphone-only were included. Sampling was stratified by province/territory and community size. The sample was then weighted to be nationally representative based on data from the 2011 Canadian Census (2).

Data Collection

The 2016 aNICS was conducted by telephone between September and October 2016 by the *Environics Research Group*. Those who agreed to participate in the survey were asked about their previous vaccinations (memory recall). Based on their responses, respondents were assigned to target groups: adults 65 years of age and older, and those aged 18 to 64 years with a chronic medical condition. Chronic medical conditions (CMC) were defined as those at increased risk for severe complications from influenza and/or pneumococcal infection as determined by NACI (3). This includes heart conditions, asthma, other chronic lung condition, cancer, diabetes, liver cirrhosis, chronic kidney disease, immune disorder/suppression, asplenic/problem with the spleen, hemoglobin problem and the presence of a cochlear implant.

Statistical Analysis

National coverage estimates for each recommended antigen were calculated as the number of positive responses (i.e. having received a vaccine) expressed as a percentage of the sum of positive and negative responses (excluding those who did not know or declined to respond). Estimates were weighted to represent the Canadian population in terms of age, gender and community size, using information from the 2011 Statistics Canada Census (2). Coverage estimates and 95% confidence intervals (95% CI) were calculated for the entire population and target groups with specific vaccine recommendations. An additional analysis was done exploring trends by age (Cochrane-Armitage test for trend) and gender (Pearson's chi-squared), for vaccines recommended to the general population. Coverage estimates over the past 6 survey cycles were presented in a table, with graphs for each vaccine. All sample sizes (n) displayed in tables are unweighted.

RESULTS FROM THE 2016 ANICS

Overall, 3,024 adult respondents completed the interview. The response rate was 10%. Among the sample, 52% of respondents were female and 20% were born outside of Canada. The median age was 57 years (range 18–102 years) with 20% being 65 years of age and older. There were 709 Canadians aged 18 to 64 years of age with a CMC (23%). Most participants had some postsecondary education (29%) or were university graduates (39%), and 29% of the sample had an annual household income of $100,000 or more before taxes.

i) Seasonal influenza vaccination

NACI recommends that all adults receive the seasonal influenza vaccine. In particular, the vaccine is recommended for adults at high-risk for influenza-related complications, those who may transmit influenza to high-risk individuals, and those who provide essential community services (4). All provinces and territories offer publicly-funded seasonal influenza vaccination programs to these high-risk groups.

Less than half of adults (40%) reported having received a dose of the influenza vaccine in the previous year. Within target groups, coverage was lowest among adults with a CMC [Table 1].

TABLE 1: Vaccination coverage for seasonal influenza vaccine among Canadian adults, 2015/16 season

PARTICIPANTS	N	COVERAGE (%) FOR ONE DOSE OF A SEASONAL INFLUENZA VACCINE (95% CI)
Adults (≥ 18 years of age)	3024	39.6 (37.6, 41.7)
18–64 years of age with a CMC*	709	40.6 (36.4, 44.8)
≥ 65 years of age	966	65.1 (61.6, 68.6)

* CMC includes heart condition, stroke, asthma, other chronic lung condition, cancer, diabetes, liver disease, chronic kidney disease, immune disorder/suppression, spleen problems/removal, hemoglobin problem, and/or cochlear implant

An association between age and reported seasonal influenza vaccination coverage was observed in the 2016 aNICS. Vaccination coverage increased from 29.2% in those aged 18–44 years, to a high of 71.9% in those greater than 75 years of age ($z' = -14.67$; $p < 0.001$). Females had statistically significantly higher reported vaccination coverage for influenza in both the 18–44 and 45–64 year age groups [Table 2].

TABLE 2: Coverage for one dose of a seasonal influenza vaccine during the 2015/2016 influenza season, by age and gender

CATEGORIES	N	MALE	FEMALE	P-VALUE[1]	TOTAL
Adults 18–44 years of age	899	25.1 (20.8–29.4)	34.3 (29.1–39.4)	< 0.001	29.2 (25.9–32.5)
Adults 45–64 years of age	1148	34.4 (29.6–39.2)	43.2 (39.0–47.5)	0.003	39.4 (36.2–42.6)
Adults 65–74 years age	584	57.1 (49.8–64.4)	61.5 (55.4–67.6)	0.438	59.4 (54.8–64.1)
Adults ≥ 75 years of age	375	73.3 (64.7–81.9)	71.1 (64.7–77.5)	0.712	71.9 (66.8–77.0)

[1] Chi-squared test (Male vs. Female)

ii) Pertussis and tetanus vaccinations

One dose of a pertussis-containing vaccine is recommended by NACI for those 18 years of age and older, if not previously immunized during adulthood (5). For adults, the pertussis booster is given in combination with tetanus and diphtheria (Tdap) in Canada. This vaccine has been recommended for adults by NACI since 2003. At the time when the survey was administered, all provinces and territories had implemented a publicly-funded Tdap vaccine program for adults (6). Less than 10% of respondents reported having received a pertussis-containing vaccine in adulthood [Table 3].

For tetanus, NACI recommends that all adults receive a booster dose of tetanus toxoid-containing vaccine every 10 years (7). Approximately 50% of Canadian adults reported receiving a vaccine against tetanus in the previous 10 years [Table 3]. Among individuals who have been treated for a wound in the last decade (n = 946), 82% reported having received a tetanus toxoid-containing vaccine.

TABLE 3: Coverage for tetanus and pertussis vaccines among adults, Canada, 2016

PARTICIPANTS	N	VACCINE COVERAGE (%) FOR AT LEAST ONE DOSE (95% CI)	
		Tetanus[5]	Pertussis[5]
Adults (≥ 18 years of age)	3024	54.0 (51.8, 56.2)	9.7 (8.4, 10.9)
≥ 65 years of age	966	45.8 (42.0, 49.6)	8.7 (6.5, 10.8)

[1] As an adult (since the age of 18 years)

[5] In the last 10 years

A decreasing trend in reported tetanus vaccination coverage was observed as age increased ($z^2 = 3.67$; $p < 0.001$). Table 4 shows that reported coverage for tetanus vaccination in the previous 10 years was highest in those 45–64 years of age (56.5%), and lowest in the oldest age group of 75+ years (41.3%). No difference in gender specific coverage was observed

TABLE 4: Coverage for one dose of a tetanus vaccine in the last 10 years, by age and gender

PARTICIPANTS AGE	N	MALE	FEMALE	P-VALUE[1]	TOTAL
Adults 18–44 years of age	845	54.4 (49.3–59.5)	56.4 (50.8–62.1)	0.471	55.3 (51.6–59.1)
Adults 45–64 years of age	1106	59.3 (54.3–64.4)	54.3 (50.0–58.7)	0.101	56.5 (53.2–59.8)
Adults 65–74 years of age	559	54.1 (46.7–61.5)	45.6 (39.1–52.1)	0.148	49.6 (44.7–54.5)
Adults ≥75 years of age	353	46.8 (37.0–56.6)	37.8 (30.4–45.2)	0.172	41.3 (35.3–47.18)

[1] Chi-squared test (Male vs. Female)

Reported pertussis vaccination coverage was similar in all age groups, with no observed trend as age group increased ($z^2 = 0.44$; $p = 0.66$). Females reported statistically significantly higher coverage than males in both the 18–44 and 45–64 year age groups [Table 5].

TABLE 5: Coverage for one dose of a pertussis vaccine since the age of 18, by age and gender

PARTICIPANTS AGE	N	MALE	FEMALE	P-VALUE[1]	TOTAL
Adults 18–44 years of age	823	6.3 (4.0–8.6)	14.1 (10.4–17.8)	<0.001	9.8 (7.7–11.9)
Adults 45–64 years of age	1084	6.2 (3.8–8.6)	13.0 (10.0–16.0)	<0.001	10.0 (8.0–12.0)
Adults 65–74 years age	545	6.3 (2.5–10.1)	8.9 (5.1–12.7)	0.415	7.7 (5.0–10.4)
Adults ≥75 years of age	363	8.3 (2.9–13.6)	10.7 (6.2–15.1)	0.532	9.8 (6.4–13.2)

[1] Chi-squared test (Male vs. Female)

iii) Pneumococcal vaccination

NACI recommends one dose of pneumococcal polysaccharide (Pneu-P-23) vaccine for all older adults (65 years of age and older) and adults with chronic conditions that are known to increase risk for invasive pneumococcal disease (3). The Pneu-P-23 vaccine is publicly-funded for both of these target groups (6). A greater proportion of older adults (42%) reported having been "vaccinated for pneumonia" in their lifetime as compared to younger adults (18–64 years of age) with chronic medical conditions (20%) [Table 6].

TABLE 6: Coverage for pneumococcal vaccine among adults, Canada, 2016

PARTICIPANTS	N	COVERAGE (%) FOR ONE DOSE OF A PNEUMOCOCCAL VACCINE (95% CI)
Adults 18–64 years of age with a CMC*	709	20.3 (16.3, 24.4)
Adults ≥ 65 years of age	966	41.6 (37.9, 45.3)

* CMC includes heart condition, stroke, asthma, other chronic lung condition, cancer, diabetes, liver disease, chronic kidney disease, immune disorder/suppression, spleen problems/removal, hemoglobin problem, and/or cochlear implant

Table 7 shows reported vaccination coverage for the pneumococcal vaccine increased from 37.7% in those aged 65–74 years to 46.3% in aged 75 years or more (x^2 = 4.07; p = 0.044). Vaccination coverage was statistically significantly higher for females (46.0%) compared to males (28.2%) in the 65–74 year age group [Table 7].

TABLE 7: Coverage for one dose of a pneumococcal vaccine since the age of 65, by age and gender

PARTICIPANTS AGE	N	MALE	FEMALE	P-VALUE[1]	TOTAL
Adults 65–74 years of age	565	28.2 (21.5–34.8)	46.0 (39.5–52.4)	0.002	37.7 (33.0–42.5)
Adults ≥75 years of age	363	41.4 (31.9–50.9)	49.3 (41.9–56.7)	0.226	46.3 (40.5–52.1)

[1] Chi-squared test (Male vs. Female)

iv) Hepatitis B vaccination

The hepatitis B vaccine is recommended by NACI for certain high-risk groups, which includes those with certain chronic medical conditions (e.g. chronic liver disease, hemophilia) (7). While routine hepatitis B vaccination programs have been implemented since the mid-1980s, either as infant or school-based programs (8), not all jurisdictions fund or recommend the vaccine for healthcare workers.

The hepatitis B vaccine coverage among those with chronic medical conditions (n = 160) was 45.1% (95% CI 35.2 to 55.0).

v) Varicella vaccination

NACI recommends that adults under 50 years of age and serologically determined to be susceptible to varicella receive two doses of a varicella vaccine (9). Among individuals under 50 years of age without a self-reported history of varicella (n = 117) more than 50% reported having received at least one dose of the varicella vaccine [Table

vi) Herpes zoster (shingles) vaccination

NACI recommends that adults 50 years of age and older receive one dose of herpes zoster vaccine (10). Among individuals 50 years of age and older (n = 1,924), 20% reported having received the herpes zoster vaccine [Table 8]. In most jurisdictions, herpes zoster vaccine is not publically funded (6).

vii) Human papillomavirus vaccination

The HPV vaccine has been recommended for women between nine and 26 years of age since 2007. Since 2010, all provinces and territories have implemented publicly funded HPV vaccination programs for pre-adolescent/adolescent girls (11). The HPV vaccine may also be administered to females between 27 and 45 years of age. As of 2012, the vaccine is also recommended for men between nine and 26 years of age, and publically funded for them in some jurisdictions at the time of the survey (7).

Among participants 18 to 26 years of age, three-quarters of females (75%, n = 71) and one quarter of males (25%, n = 82), reported receiving at least one dose of the HPV vaccine. Among females 27 to 45 years of age (n = 371), 11% reported they were vaccinated with at least one dose of the HPV vaccine [Table 8].

TABLE 8: Coverage for varicella, shingles, human papilloma virus vaccines among adults, Canada, 2016

PARTICIPANTS AGE (YEARS)	N	VACCINE COVERAGE (%) FOR AT LEAST ONE DOSE (95% CI)		
		VARICELLA[1]	SHINGLES[2]	HUMAN PAPILLOMA VIRUS
Adults ≤ 50	117	52.3 (41.4, 63.2)	-	-
Adults ≥ = 50	1,924	-	20.4 (18.3, 22.5)	-
Males > = 26	82	-	-	25.2 (13.5, 36.9)
Females < = 26	71	-	-	75.0 (63.4, 86.5)
Females 27–45	371	-	-	10.6 (7.1, 14.2)

[1] Adults younger than 50 years of age who reported not having had varicella infection

[2] Adults 50 years of age and older

viii) Vaccine knowledge and beliefs

Most adults (79%) reported that they knew enough about the benefits of vaccines. While 88% of individuals believed that they received all of the vaccines recommended for someone their age, only 3% of respondents reported having received all of the recommended adult vaccines for their age/risk group.

NATIONAL COVERAGE GOALS AND COVERAGE TRENDS (2006–2016 ANICS CYCLES)

Vaccination Coverage Goals and VPD Disease Reduction Targets for Canada were first developed in 1992 and have been revised and expanded through a series of Consensus Conferences. The national vaccination coverage goals were recently updated in 2017, and apply to adult vaccines as follows:

- Achieve 80% vaccination coverage (one dose) of a pneumococcal vaccine among adults 65 years of age and older.
- Achieve 90% vaccination coverage (one dose) of hepatitis B vaccine among healthcare professionals.
- Achieve 80% vaccination coverage (one dose per season) of an influenza vaccine among adults aged 65 years and older, aged 18–64 years with high risk conditions, and health care professionals.

Table 9 presents national vaccination coverage goals in Canada and the United States for vaccines recommended to adults with national coverage goals [HCW data not available]. Seasonal influenza vaccination coverage for the general adult population was similar in both Canada and the United States (14), but estimates were below the 80% national coverage goal (13). Pneumococcal vaccine coverage among adults 65 years of age and older was just over half (42%) the national goal of 80% (13). [Table 9].

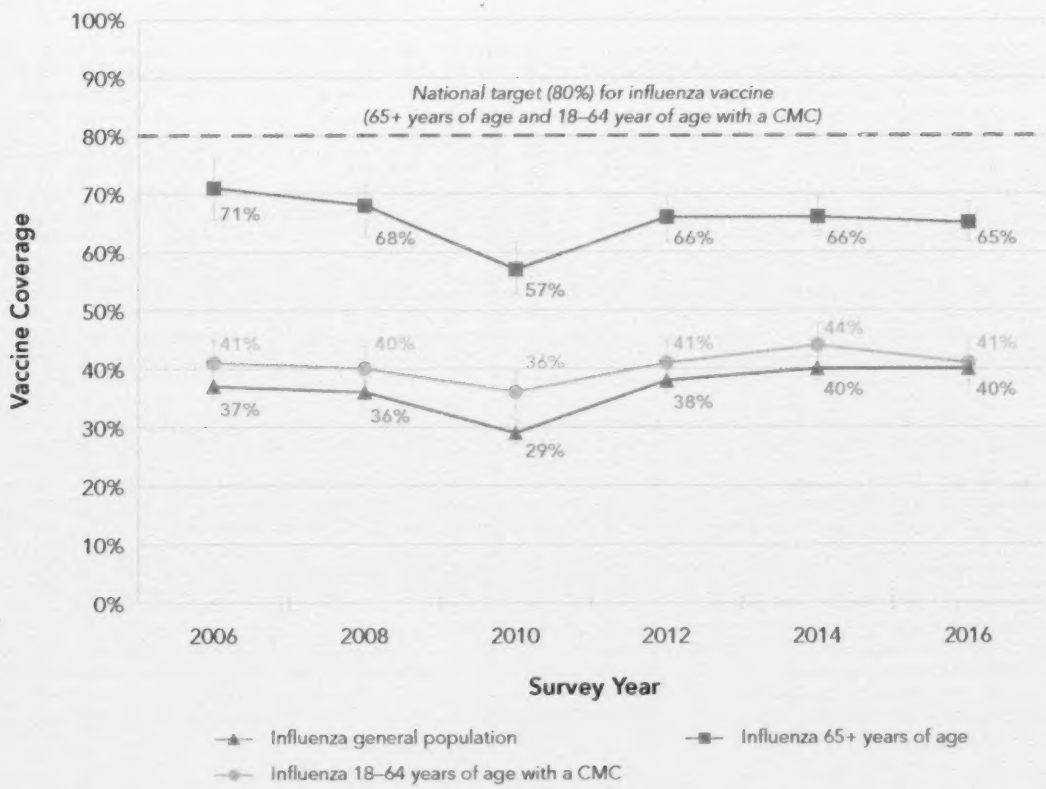
TABLE 9: Estimated vaccine coverage among adults in 2016 for seasonal influenza, pneumococcal, and hepatitis B vaccine

		CANADA		UNITED STATES[14,15]	
ANTIGEN	GROUP	GOAL[13] (%)	COVERAGE (%)	GOALS (%)	COVERAGE (%)
Pneumococcal	18–64 years of age with a CMC*	n/a	20	60	21
	≥ 65 years of age	80	42	90	60
Seasonal Influenza	General population	n/a	40	70	39
	18–64 years of age with a CMC*	80	41	n/a	n/a
	≥ 65 years of age	80	65	n/a	n/a

* CMC includes heart condition, stroke, asthma, other chronic lung condition, cancer, diabetes, liver disease, chronic kidney disease, immune disorder/suppression, spleen problems/removal, hemoglobin problem, and/or cochlear implant

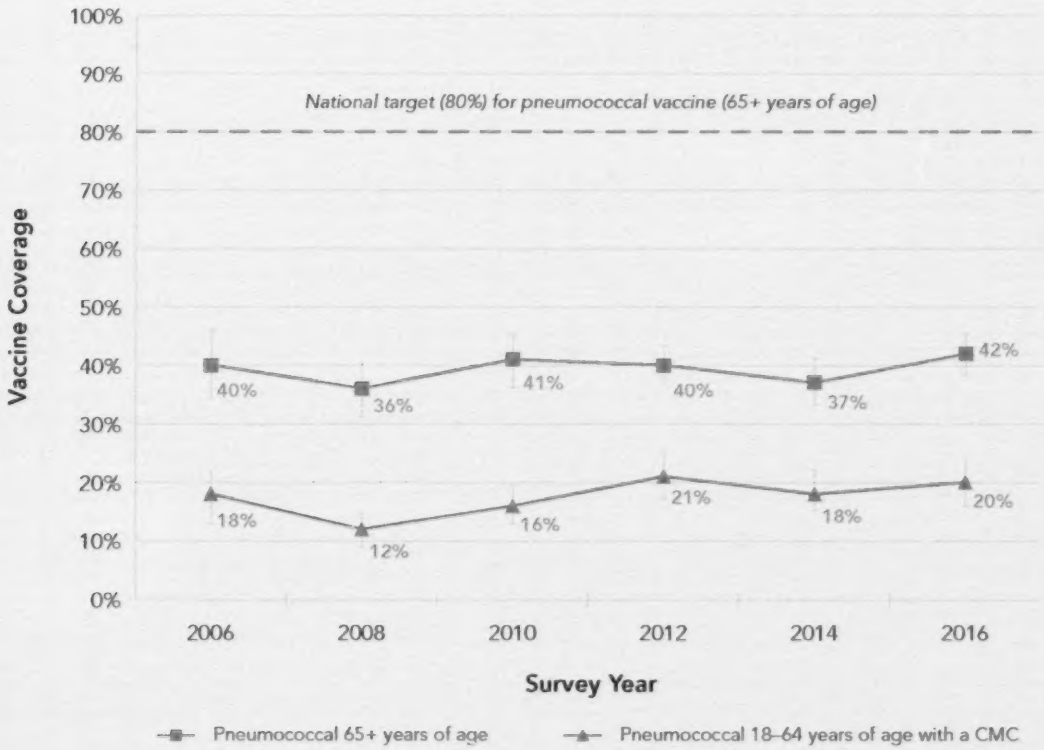
Vaccination coverage in the general population remained relatively stable for seasonal influenza vaccine over the last ten years [Figure 1]. A decrease in coverage was observed in 2010, likely the result of the availability and preferential uptake of the pandemic A/H1N1 vaccine that was offered during the same time period (12). Although influenza vaccination coverage for adults 65 years of age and older is higher than the general population, it is still below the national goal of 80%.

FIGURE 1: Seasonal influenza vaccine coverage from 2006 to 2016



The reported uptake of pneumococcal vaccine has remained stable in adults aged 65 years and older, and those aged 18–64 with a CMC [Figure 2]. Vaccination coverage in both groups is below the national target.

FIGURE 2: Pneumococcal vaccine coverage from 2006 to 2016



Tetanus vaccination coverage has remained stable over time in Canadian adults. Reported pertussis vaccination coverage has increased over survey cycles, but remains low [Figure 3]. There are no national coverage goal for adult pertussis and tetanus vaccination.

FIGURE 3: Pertussis and tetanus vaccines coverage from 2006 to 2016

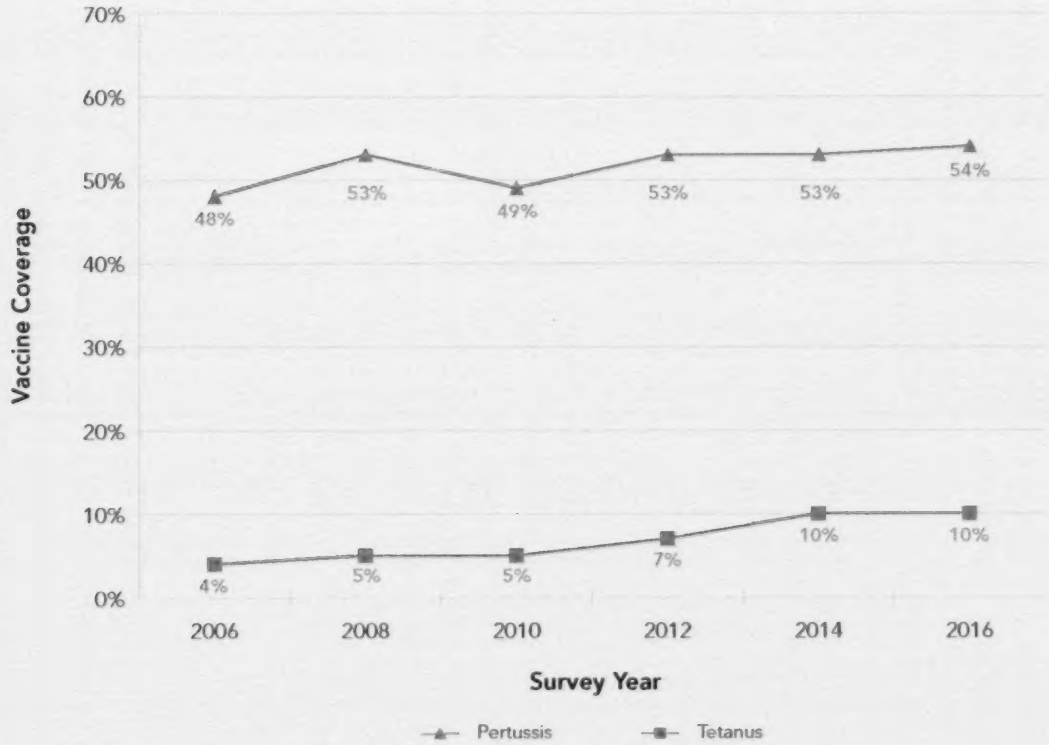


Table 10 presents coverage estimates of recommended vaccines in the general population for the last six cycles of the aNICS.

TABLE 10: Estimated vaccine coverage among adults from 2006 to 2016 for seasonal influenza, pneumococcal, pertussis, tetanus, and hepatitis B vaccines

GROUP	2006	2008	2010	2012	2014	2016
Seasonal Influenza						
General Population	37.5 (35.4–39.6)	36.1 (34.1–38.0)	28.9 (27.0–30.8)	37.6 (35.7–39.6)	40.4 (38.4–42.5)	39.6 (37.6–41.7)
65+ years of age	71.3 (65.9–76.7)	67.6 (63.4–71.7)	57.4 (53.2–61.7)	65.9 (62.2–69.7)	66.3 (62.7–70.0)	65.1 (61.6–68.6)
18–64 years of age with a CMC*	40.5 (35.8–45.3)	40.0 (35.9–44.0)	35.9 (31.9–40.0)	40.7 (36.7–44.7)	43.8 (39.6–48.1)	40.6 (36.4–44.8)
Pneumococcal						
65+ years of age	39.9 (34.2–45.7)	35.9 (31.5–40.2)	40.6 (36.4–44.8)	39.5 (35.6–43.5)	36.8 (33.0–40.7)	41.6 (37.9–45.3)
18–64 years of age with a CMC*	17.6 (13.1–22.1)	12.3 (9.3–15.3)	16.3 (12.9–20.0)	21.1 (17.2–25.1)	18.3 (14.6–22.0)	20.3 (16.3–24.4)
Pertussis						
General Population	4.0 (3.1–4.9)	5.0 (4.1–5.9)	5.4 (4.4–6.3)	7.1 (6.1–8.2)	9.9 (8.6–11.3)	9.7 (8.4–10.9)
Tetanus						
General Population	48.1 (45.9–50.3)	52.6 (50.5–54.7)	49.1 (46.9–51.3)	53.0 (50.9–55.1)	52.7 (50.6–54.9)	54.0 (51.8–56.2)

Vaccine coverage estimates are displayed as a % (95% confidence intervals).

* CMC = CMC includes heart condition, stroke, asthma, other chronic lung conditions, cancer, diabetes, liver cirrhosis, chronic kidney disease, immune disorder/suppression

DISCUSSION

In the 2016 aNICS survey, reported vaccination coverage among Canadian adults was below the national vaccination coverage goals for influenza and pneumoccocal vaccines (13). In the general adult population, vaccination coverage against pertussis was the lowest among all vaccines covered by publicly-funded programs. As identified by another study, there is low awareness of the Tdap vaccine among Canadian adults (16). Vaccination against pertussis may be under-reported by individuals who are unaware that the antigen is given as part of the combination vaccine that includes tetanus.

Vaccination coverage for target groups at high-risk for severe complications were also suboptimal. Adults aged 65 years and older reported higher coverage for the seasonal influenza and pneumococcal vaccines as compared to individuals with chronic medical conditions, but estimates remain below the national goals. Individuals unaware that they are considered as a high-risk group may contribute to low coverage (17).

LIMITATIONS

There are limitations to the 2016 aNICS study. The low response rate increases the risk of non-response bias (i.e. vaccine uptake may be different in those who did not participate) and limits the representativeness of the sample.

Results are based solely on self-reported vaccination history. The ability of the participant to recall specific vaccinations is influenced by their existing knowledge of vaccines and their understanding of the risks associated with vaccine preventable diseases. The self-reported results are likely to impact the accuracy and reliability of the estimates, resulting in under- or overestimation of vaccination coverage.

Self-reported chronic medical conditions were not validated with medical records, which may have resulted in misclassification of individuals in high-risk groups. The aNICS results may not be directly comparable to coverage data reported by other countries because of differences in definitions of high-risk groups and methods used to measure vaccination coverage.

CONCLUSION

Vaccination coverage estimates varied across adult target groups. There is room for improvement, as many Canadians are not up-to-date in their vaccinations according to NACI-recommended schedules.

Ongoing effort to promote and educate the adult population on the benefits (safety and effectiveness) of recommended vaccines is required in order to increase uptake, particularly among those who are considered high-risk. We must continue to improve our understanding of factors influencing vaccine coverage rates, and to evaluate and identify effective strategies and interventions that increase uptake.

The aNICS measures adult vaccination coverage in Canada and results are used to monitor progress towards national vaccination coverage goals. The Public Health Agency of Canada will continue to collaborate with provinces, territories and other stakeholders to improve vaccination coverage assessment surveys to capture factors influencing vaccine uptake. This in turn will inform vaccination programs and outreach campaigns to promote an increase in vaccine uptake among Canadian adults.

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